

# PATENT COOPERATION TREATY


# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

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Applicant's or agent's file reference E-1837/03		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/IT 03/00568	International filing date (day/month/year) 24.09.2003	Priority date (day/month/year) 24.09.2003	
International Patent Classification (IPC) or both national classification and IPC E02D27/48			
Applicant SO.L.E.S. - SOCIETA' LAVORI EDILI E SERBATOI S P A			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 7 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>			
Date of submission of the demand  20.04.2005		Date of completion of this report  23.01.2006	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer  De Neef, K  Telephone No. +31 70 340-4340	



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IT 03/00568

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, Pages

5-29	as originally filed
1-4	received on 20.04.2005 with letter of 20.04.2005

### Claims, Numbers

1-93	as originally filed
94	received on 20.04.2005 with letter of 20.04.2005
95-101	received on 30.08.2005 with letter of 30.08.2005

### Drawings, Sheets

1/9-9/9	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-101
	No: Claims	
Inventive step (IS)	Yes: Claims	1-101
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-101
	No: Claims	

2. Citations and explanations

**see separate sheet**

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**Re Item V: Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**CLAIM 1**

US-A-5234287 (D1) discloses with reference to figures 1-3 a method of constructing a pile foundation; the method comprising the steps of building on the ground a foundation structure have at least one through hole; inserting a metal pile (30), comprising a rod and at least one bottom main head (34), through said hole, so that the main head of the pile contacts the ground; statically applying at least one thrust on the pile to drive the pile into the ground; and fixing the driven pile axially to the foundation structure.

The subject-matter of claim 1 differs from this known method in that the transverse dimensions of the main head are greater than those of the hole when driving the main head into the ground. Therefore the subject-matter of claim 1 is new, Article 33(2) PCT.

The features related to said contribution solve the problem of impairing the capacity of the foundation structure with a larger hole in said structure. This solution has not been disclosed in the entire state of the art, neither is it obvious, hence D1 discloses a stabilizing method for existing structures making the inserting through a smaller hole impossible.

Therefore the subject-matter of claim 1 is considered as involving an inventive step (Article 33(3) PCT).

**DEPENDENT CLAIMS 2-95**

Claims 2-95 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**CLAIM 96**

D1 discloses a foundation structure on the ground comprising at least one through hole and at least one metal pile (30), which is inserted through the through hole, is fixed axially to the foundation structure, and comprises a rod and at least one bottom main head (34) contacting the ground.

The subject-matter of claim 96 differs from this known structure in that the transverse dimensions of the main head are greater than those of the hole. Therefore the subject-matter of claim 1 is new, Article 33(2) PCT.

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The features related to said contribution solve the problem of impairing the capacity of the foundation structure with a larger hole in said structure. This solution has not been disclosed in the entire state of the art, neither is it obvious, hence D1 discloses a stabilizing method for existing structures making the inserting through a smaller hole impossible.

Therefore the subject-matter of claim 96 is considered as involving an inventive step (Article 33(3) PCT).

**DEPENDENT CLAIMS 97-101**

Claims 97-101 are dependent on claim 96 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

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## METHOD OF CONSTRUCTING A PILE FOUNDATION

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TECHNICAL FIELD

The present invention relates to a method of constructing a pile foundation, in particular of a building.

BACKGROUND ART

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A pile foundation of a building is constructed by building a ground foundation structure of the building, having at least one through hole and fitted through, adjacent to the hole, with at least two cables fixed to the structure and projecting upwards. Once the foundation structure is completed, a metal pile is inserted through  
20 the hole and subjected to a series of static thrusts to drive it into the ground; and, once driven, the top of the pile is fixed axially to the foundation structure. Each thrust is applied by a thrust device, which is set  
25 up on top of the pile, cooperates with the top end of the pile, and is connected to the projecting portions of the cables, which, when driving the pile, act as reaction members for the thrust device.

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The pile comprises a constant-section rod; and a wide bottom head, which is connected integrally to the rod and substantially the same size across as the hole so as to fit through it. When driving the pile, the head forms, in the ground, a channel larger across than the rod, and, as the pile is being driven, substantially plastic cement is fed into the part of the channel not occupied by the rod, so as to form a cement jacket about the pile.

Especially in soft ground, the transverse dimensions of the head should be particularly large to form a relatively large channel in the ground and, hence, a cement jacket large enough to ensure the required stability. The transverse dimensions of the head, however, are limited by those of the hole, which, over and above a given size, seriously impairs the capacity of the foundation structure, and makes it difficult to fix the sunk pile axially to the foundation structure.

US5234287A1 discloses an apparatus and a process for stabilizing foundations; a foundation having a wall is stabilized by attaching a bracket to the wall, coupling a jacking apparatus to the bracket, inserting pier sections into the jacking apparatus and driving them with that apparatus, one after the other, through the bracket and into the soil which underlies the foundation, and coupling the pier so formed to the bracket so as to support the foundation through the pier. The bracket has a plate which fits against the wall and is attached to it

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with bolts and a sleeve which is attached firmly to the plate intermediate the ends of the plate; the pier passes through the sleeve and is connected to the sleeve, once it encounters adequate resistance, so as to support the foundation.

US3786641A1 discloses a method for providing solid columnar support under structural layer, overlying earth materials of an earth situs. Expansible agitator means projected through relatively small diameter hole in overlying layer and expanded to agitate and loosen earth materials to define elongated body thereof of greater peripheral size than hole; self-hardenable fluid pumped through hole into loosened earth, is allowed to harden after removal of contracted agitator means through small hole. Resultant rigid, composite column underlies area of structural layer surrounding hole for the solid support designed to eliminate the aforementioned drawbacks, and which, at the same time, are cheap and easy to implement.

According to the present invention, there is provided a method and a pile of constructing a pile foundation, as recited in the attached claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

A number of non-limiting embodiments of the present invention will be described by way of example with



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reference to the accompanying drawings, in which:

Figure 1 shows a schematic front section of a foundation pile which is driven using the method according to the present invention;

5 Figure 2 shows a section along line II-II of the Figure 1 pile;

Figure 3 shows a larger-scale front section of an initial configuration, prior to driving the Figure 1 pile;

10 Figure 4 shows the Figure 1 pile driven in;

Figures 5 and 6 show two stages in the driving of an alternative embodiment of the Figure 1 pile;

15 Figures 7 and 8 show larger-scale front sections of two alternative embodiments of a detail of the Figure 1 pile;

Figure 9 shows a front section of a further embodiment of the Figure 1 pile;

20 Figure 10 shows a larger-scale front section of an initial configuration, prior to driving an alternative embodiment of the Figure 1 pile;

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differing in shape and/or thickness.

91) A method as claimed in one of Claims 1 to 89, wherein the pile (3) comprises a jacket of cement material (31) surrounding the rod (9); the transverse dimension of the jacket of cement material (31) of the pile (3) differing along the longitudinal axis of the pile (3).

92) A method as claimed in Claim 91, wherein the difference in the transverse dimension of the jacket of cement material (31) is achieved by adjusting the transverse dimension of the main head (10) as the main head (10) is driven in.

93) A method as claimed in Claim 91, wherein the difference in the transverse dimension of the jacket of cement material (31) is achieved by differentially injecting the cement material (31) through at least one through hole (52) formed along the rod (9).

94) A method as claimed in one of Claims 1 to 93, and further comprising the steps of driving at least one auxiliary pile into the ground (2) when building the foundation structure (1); and removing the auxiliary pile once the foundation structure (1) is completed; to remove the auxiliary pile, the auxiliary pile is subjected statically to pull generated by an extracting device connected mechanically at one end to a top end of the auxiliary pile, and resting at the other end on the foundation structure (1), which acts as a reaction member for the extracting device.

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for the extracting device.

95) A method as claimed in Claim 94, wherein the extracting device comprises at least two hydraulic jacks on opposite sides of the auxiliary pile; the movable output member of each hydraulic jack being connected mechanically to the auxiliary pile; and the bodies of the two hydraulic jacks resting on the foundation structure (1).

96) A foundation structure (1) on the ground (2) comprising at least one through hole (4) and at least one metal pile (3), which is inserted through the through hole (4), is fixed axially to the foundation structure (1), and comprises a rod (9) and at least one bottom main head (10) contacting the ground (2); the foundation structure (1) is characterized in that the transverse dimensions of the main head (10) are greater than those of the hole (4).

97) A foundation structure (1) as claimed in Claim 96, wherein the main head (10) is pointed.

98) A foundation structure (1) as claimed in Claim 96 or 97, wherein the rod (9) differs in thickness and/or shape along the longitudinal axis of the pile (3).

99) A foundation structure (1) as claimed in Claim 96, 97 or 98, wherein the pile (3) comprises a jacket of cement material (31) surrounding the rod (9); and the transverse dimension of the jacket of cement material (31) of the pile (3) differing along the longitudinal

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axis of the pile (3).

100) A foundation structure (1) as claimed in Claim 99, wherein the jacket of cement material (31) at an intermediate segment of the pile (3) has a larger transverse dimension than at a top end segment of the pile (3).

101) A foundation structure (1) as claimed in Claim 99, wherein the jacket of cement material (31) at a bottom segment of the pile (3) has a larger transverse dimension than at a top end segment of the pile (3).